PATENT SPECIFICATION

652,662

Date of filing Complete Specification (under Section 16 of the Patents and Designs Acts, 1907 to 1946) May 10, 1949.
Application Date June 4, 1948. No. 15986/48.
Application Date May 2, 1949. No. 11695/49.
Complete Specification Published April 25, 1951.

Index at acceptance:—Class 78(i), A3, S6.

PROVISIONAL SPECIFICATION
No. 15986, A.D. 1948.

SPECIFICATION No. 652662

By a direction given under Section 17(1) of the Patents Act 1949 this application proceeded in the name of F. L. Smidth & Co., A/S, a Danish Company, of 33, Vestergade, Copenhagen K, Denmark.

THE PATENT OFFICE,
23rd May, 1951

DS 82312/1(I)/3531 160 5/51 R

filling bags or similar containers with predetermined quantities of powdered material weighed by the machine itself. In some machines of this kind the powdered material is rendered fluid by introducing air or other gas under pressure into the tank and agitating the material and air by a rotary agitator.

The most satisfactory form of machine is one in which the tank rotates about a vertical axis and carries with it a series of filling spouts leading from the discharge openings, the bags being suspended on these spouts during the filling operation and each making one revolution with the machine.

Application No. 21858/46 describes a machine of this kind in which the need to provide any rotary agitator is eliminated and the material around the discharge opening or openings is brought into the desired fluid state solely by introducing the air or other gas into the tank as a multiplicity of small streams in the neighbourhood of the discharge opening or openings. To divide the air or other gas up into a multiplicity of small streams it may be forced through porous material forming part of the bottom of the tank or through pipes arranged in the bottom of the tank and either made of porous material or formed with holes covered by porous material. In this machine it is not necessary to aerate the material in the body of the tank, although in fact all the material may be aerated. By eliminating the rotary agitator the construction is simplified and the bags may have to make two revolutions with the machine in order to be filled. When the filling tank is to be completely emptied after all the packing and weighing operations have been completed, it is necessary for all the discharge openings of the tank to be opened if the emptying is not to take a very long time; this is a nuisance because a bag has to be put on each spout and the material left in the tank enters all these without filling any of them.

According to the present invention these minor drawbacks in a rotary machine constructed as described in Application No. 21858/46 are overcome by providing a fixed baffle system in the tank immediately above the discharge opening or openings. This baffle system stops the mass of powdered material from being carried round as a whole with the tank. Instead those parts of the system beneath which the discharge opening or openings pass break up any irregular masses of material and distribute the material uniformly throughout the space round each discharge opening and so accelerate the production of the fluid-like state in the neighbourhood of each opening. The same action leads to complete discharge of the material through a single opening in a reasonable period of time when the tank has to be completely emptied.

The preferred form of machine according to the present invention, together with one modification, will now be described by way of example with reference to the accompanying drawings in which:—

[ ]

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Index at acceptance:—Class 78 (i), A3, S6.

PROVISIONAL SPECIFICATION
No. 15986, A.D. 1948.

Improvements relating to Machines for Weighing and Packing Powdered Material

We, F. L. SMIDTH & Co. A/S, a Danish Company, of 33, Vestergade, Copenhagen K, Denmark, and CECIL EDWARD EVERY a British Subject, of 51—52, Chancery Lane, London, W.C.2, do hereby declare the nature of this invention (a communication from the said F. L. Smidth & Co., to the said C. E. Every) to be as follows:—

This invention relates to machines for filling bags or similar containers with predetermined quantities of powdered material weighed by the machine itself. In some machines of this kind the powdered material is rendered fluid by introducing air or other gas under pressure into the tank and agitating the material and air by a rotary agitator.

The most satisfactory form of machine is one in which the tank rotates about a vertical axis and carries with it a series of filling spouts leading from the discharge openings, the bags being suspended on these spouts during the filling operation and each making one revolution with the machine.

Application No. 21858/46 describes a machine of this kind in which the need to provide any rotary agitator is eliminated and the material around the discharge opening or openings is brought into the desired fluid state solely by introducing the air or other gas into the tank as a multiplicity of small streams in the neighbourhood of the discharge opening or openings. To divide the air or other gas up into a multiplicity of small streams it may be forced through porous material forming part of the bottom of the tank or through pipes arranged in the bottom of the tank and either made of porous material or formed with holes covered by porous material. In this machine it is not necessary to aerate the material in the body of the tank, although in fact all the material may be aerated. By eliminating the rotary agitator the construction is simplified and power is saved. However, when such a machine is started it is necessary to use a somewhat larger amount of air than when the machine is in continuous operation. This increased amount of air may lead to an irregular discharge of material for a short period after the start; also it may lengthen the period required to fill the bags or the like, for which reason some of the bags may have to make two revolutions with the machine in order to be filled. When the filling tank is to be completely emptied after all the packing and weighing operations have been completed, it is necessary for all the discharge openings of the tank to be opened if the emptying is not to take a very long time; this is a nuisance because a bag has to be put on each spout and the material left in the tank enters all these without filling any of them.

According to the present invention these minor drawbacks in a rotary machine constructed as described in Application No. 21858/46 are overcome by providing a fixed baffle system in the tank immediately above the discharge opening or openings. This baffle system stops the mass of powdered material from being carried round as a whole with the tank. Instead those parts of the system beneath which the discharge opening or openings pass break up any irregular masses of material and distribute the material uniformly throughout the space round each discharge opening and so accelerate the production of the fluid-like state in the neighbourhood of each opening. The same action leads to complete discharge of the material through a single opening in a reasonable period of time when the tank has to be completely emptied.

The preferred form of machine according to the present invention, together with one modification, will now be described by way of example with reference to the accompanying drawings in which:—

[ ]

Figure 1 is a diagrammatic vertical section through the machine;

Figure 2 shows the part around one discharge opening on a larger scale;

Figure 3 is a section on the line III—III in Figure 2;

Figure 4 is a view similar to Figure 2 of a modified construction, and

Figure 5 is a section on the line V—V in Figure 4.

The machine shown in Figure 1 consists essentially of a cylindrical tank 1 fixed to a vertical shaft 2. The shaft 2 is carried by a bearing not shown and rotates when the apparatus is in operation. It passes through the bottom of the tank, which is shown at 32, and outside the tank is surrounded by a collar 4 held in position by nuts 31 which are threaded onto the end of the shaft. The tank has an upper cover 13 with an opening 3 through which material can be introduced into the tank and a cylindrical skirt 15, the cover being suspended from beams 12. Above the bottom 32 the tank has a conical wall 14 and outside this there is an annular horizontal part containing discharge openings 5 which lead to rubber tubes 6 which in turn lead to spouts 7. The flow through each tube 6 can be stopped by pushing a device 16 into contact with the tube. Each spout 7 has a nozzle 8 on which a bag can be held by a gripper 10. The spout 7 is suspended by rods 9 from a weighing beam not shown which rotates with the tank and when each bag is to be released the gripper 10 is lifted by a mechanism which includes a roller 11 operated by a cam rail. All the parts so far described, except the conical wall 14, are of usual construction.

The shaft 2 is hollow and formed with openings 18. Compressed air is introduced through a stationary pipe 19 which enters the lower end of the shaft 2 and this air flows through the openings 18 into a space 17 within the conical wall 14 and above the bottom 32. The air flows from the space 17 through pipes 20 to circular pipes 25 which run around the bottom of the tank and are arranged one on each side of the row of openings 5. These pipes are made of porous material so that the air in them flows out in a multiplicity of small streams and mixes with the powdered material above the openings 5. It converts this material to a fluid state so that the material can flow uniformly through the opening to the bags. The features just described are the subject of Application No. 21858/46.

The baffle system provided according to the present invention consists of bars 26 extending downwards from the cover 13 and on reaching the cone 14 running more or less parallel to it, these bars being held by three rings 27, 28 and 29. The ring 29 is fixed to the lower end of the bars and plate-like elements 30 which lie in or close to radial planes of the tank are fixed to it. These elements 30 are in fact the wings of U-shaped members the bases of which are welded to the rings 29 as shown in Figure 3. When the tank rotates the baffle system remains stationary and the existence of the elements 30 ensures that the material immediately above the pipes 25 is constantly disturbed and levelled so that as each outlet 5 travels beneath the elements 30 the material will flow uniformly and rapidly to and through it.

It will be seen that in the construction shown in Figures 1 to 3 the air is admitted above the mouths of the discharge openings. This may lead to the formation of pockets in the material and these can be avoided by the modified construction shown in Figures 4 and 5. Here the air enters the tank through porous plates 21 which lie in a frame forming the upper part of the air supply chamber 22 with inlets 23. The mouths of the discharge openings 5 lie in the same planes as the upper surfaces of the plates 21 and this plane is only just below the lower edges of the plate-like elements 30. With the construction shown particularly in Figure 5 no air will be supplied in the small area around each of the outlet openings 5 but of course the plates may be so shaped that they surround these openings closely.

It is to be understood that although the invention is illustrated as applied to the kind of machine shown in Figure 1 it is not limited to this type of machine since the weighing devices, the filling spouts and the air-supply devices may all be of other forms. Moreover the baffle system may be varied; for exampe the conical wall 14 may be replaced by a cylinder and the bars of the baffle system may then be wholly parallel to the axis of the tank. Again, the elements 30 may be carried by vertical arms and may form the ends of such arms. Finally there may be additional elements 30 above those shown.

Dated this 14th day of June, 1948.

For the Applicants:
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52, Chancery Lane,
London, W.C.2.

PROVISIONAL SPECIFICATION
No. 11695, A.D. 1949.

Improvements relating to Machines for Weighing and Packing Powdered Material

We, F. L. SMIDTH & Co. A/S, a Danish Company, of 33, Vestergade, Copenhagen K, Denmark, and CECIL EDWARD EVERY a British Subject, of 51—52, Chancery Lane, London, W.C.2, do hereby declare the nature of this invention to be as follows:—

This invention relates to machines for filling bags or similar containers with predetermined quantities of powdered material weighed by the machine itself.

The most satisfactory type of machine is one in which the tank rotates about a vertical axis and carries with it a series of filling spouts leading from the discharge openings, the bags being suspended on these spouts during the filling operation. The invention is concerned with machines of this type.

In machines of the type set forth it is, of course, necessary to make the material flow uniformly through the discharge openings if the operation is to be satisfactory. With this object in view the machines in the past have been provided with agitators rotating much faster than the tank. Such an agitator, however, needs a separate driving motor and complicates the machine considerably. The operation can be improved by introducing air or other gas under pressure into the tank to increase the fluidity of the powdered material.

Application No. 21858/46 describes a machine of this kind in which the need to provde any rotary agitator is eliminated and the material around the discharge openings is brought into the desired fluid state solely by introducing the air or other gas into the tank as a multiplicity of small streams in the neighbourhood of the discharge openings. To divide the air or other gas up into a multiplicity of small streams it may be forced through porous material forming part of the bottom of the tank or through pipes arranged in the bottom of the tank and either made of porous material or formed with holes covered by porous material. In this machine it is not necessary to aerate the material in the body of the tank, although in fact all the material may be aerated. By eliminating the rotary agitator the construction is simplified and power is saved. However, when such a machine is started it is necessary to use a somewhat larger amount of air than when the machine is in continuous operation. This increased amount of air may lead to an irregular discharge of material for a short period after the start; also it may lengthen the period required to fill the bags or the like, for which reason some of the bags may have to make two revolutions with the machine in order to be filled. When the filling tank is to be completely emptied after all the packing and weighing operations have been completed, it is necessary for all the discharge openings of the tank to be opened if the emptying is not to take a very long time; this is a nuisance because a bag has to be put on each spout and the material left in the tank enters all these without filling any of them.

In our Application No. 15986/48 we have described the provision of a fixed baffle system in the tank immediately above the discharge openings in a rotary machine constructed as described in Application No. 21858/46. This baffle system stops the mass of powdered material from being carried round as a whole with the tank. Instead those parts of the system beneath which the discharge opening pass break up any irregular masses of material and distribute the material uniformly throughout the space round each discharge opening and so accelerate the production of the fluid-like state in the neighbourhood of each opening. The same action leads to complete discharge of the material through a single opening in a reasonable period of time when the tank has to be completely emptied.

The present invention is based on the discovery that in machines used with the more inherently fluid materials (e.g. ordinary Portland cement), it is possible to eliminate the air supply as well as any rotory agitator entirely by using a fixed baffle system. This may be constructed as described in Application No. 15986/48, but preferably it comprises radial arms or elements projecting beyond an annular stationary plate into a narrow annular area which includes the discharge openings. The stationary plate may be supported by fixed radial arm of slightly greater radial length than the radial thickness of the annulus, or the plate may be supported in any suitable way and be furnished on its periphery with radial projections which constitute the baffle system. The plate takes the weight of most of the mass of material and by so doing reduces the frictional resistance set up on starting, when the tank begins to turn and the inertia of the material is considerable.

Dated this 2nd day of May, 1949.

For the Applicants:
GILL, JENNINGS & EVERY.
Chartered Patent Agents,
51/52, Chancery Lane,
London, W.C.2.

COMPLETE SPECIFICATION

Improvements relating to Machines for Weighing and Packing Powdered Material

We, F. L. SMIDTH & Co. A/S. a Danish Company, of 33, Vestergade, Copenhagen K, Denmark, and CECIL EDWARD EVERY a British Subject, of 51—52, Chancery Lane, London, W.C.2. do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to machines for filling bags or similar containers with predetermined quantities of powdered material weighed by the machine itself.

The most satisfactory type of machine is one in which a tank rotates about a vertical axis and carries with it a series of filling spouts leading from discharge openings lying at the bottom of the tank and disposed around the axis, the bags being suspended on these spouts during the filling operation. The invention is concerned with machines of this type.

In machines of the type set forth it is, of course, necessary to make the material flow uniformly through the discharge openings if the operation is to be satisfactory. With this object in view the machines in the past have been provided with agitators rotating much faster than the tank. Such an agitator, however, needs a separate driving motor and complicates the machine considerably. The operation can be improved by introducing air or other gas under pressure into the tank to increase the fluidity of the powdered material.

Application No. 21858/46 describes a machine of this kind in which the need to provide any rotary agitator is eliminated and the material around the discharge opening or openings is brought into the desired fluid state solely by introducing the air or other gas into the tank as a multiplicity of small streams in the neighbourhood of the discharge opening or openings. To divide the air or other gas up into a multiplicity of small streams it may be forced through porous material forming part of the bottom of the tank or through pipes arranged in the bottom of the tank and either made of porous material or formed with holes covered by porous material. In this machine it is not necessary to aerate the materials in the body of the tank, although in fact all the material may be aerated. By eliminating the rotary agitator the construction is simplified and power is saved. However, when such a machine is started it is necessary to use a somewhat larger amount of air than when the machine is in continuous operation. This increased amount of air may lead to an irregular discharge of material for a short period after the start; also it may lengthen the period required to fill the bags or the like, for which reason some of the bags may have to make revolutions with the machine in order to be filled. When the filling tank is to be completely emptied after all the packing and weighing operations have been completed, it is necessary for all the discharge openings of the tank to be opened if the emptying is not to take a very long time; this is a nuisance because a bag has to be put on each spout and the material left in the tank enters all these without filling any of them.

Our object in this invention is to eliminate the need for any rotary agitator and at the same time to eliminate or reduce to a minimum the supply of air to the tank.

According to the present invention the discharge openings lie in a narrow area at the bottom and close to the periphery of the tank; the tank is so constructed, or provided with internal elements such that the material within it is directed radially outwards to the narrow area and so to the discharge openings and a fixed baffle system is provided in the tank immediately above the discharge opening or openings. The purpose of this baffle system is to stop the mass of powdered material from being carried round as a whole with the tank. Instead those parts of the baffle system beneath which the discharge opening or openings pass break up any irregular masses of material and distribute the material uniformly throughout the space round each discharge opening, so that it will flow uniformly through the opening. The same action leads to complete discharge of the material through one only of the openings in a reasonable period of time when the tank has to be completely emptied.

The preferred form of machine according to the present invention, together with

some modifications, will now be described by way of example with reference to the drawings accompanying Provisional Specification No. 15986/48 and the accompanying drawings. In the drawings accompanying Provisional Specification No. 15986/48:—

Figure 1 is a diagrammatic vertical section through the machine;

Figure 2 shows the part around one discharge opening on a larger scale;

Figure 3 is a section on the line III—III in Figure 2;

Figure 4 is a view similar to Figure 2 of a modified construction; and

Figure 5 is a section on the line V—V in Figure 4.

In the accompanying drawings, Figure 1 is a diagrammatic vertical section through the tank of another machine; and Figure 2 is a section, similar to Figure 1, through yet another tank.

The machine shown in Figures 1 to 3 of the drawings accompanying Provisional Specification No. 15896/48 consists essentially of a cylindrical tank 1 fixed to a vertical shaft 2. The shaft 2 is carried by a bearing not shown and rotates when the aparatus is in operation. It passes through the bottom of the tank, which is shown at 32, and outside the tank is surrounded by a collar 4 held in position by nuts 31 which are threaded onto the end of the shaft. The tank has a stationary upper cover 13 with an opening 3 through which material can be introduced into the tank, and a cylindrical skirt 15, the cover being suspended from beams 12. Above the bottom 32 the tank has an impervious conical wall 14 which rotates with the tank and outside this there is a horizontal part of the bottom 32 forming a narrow annular area containing discharge openings 5 which lead to rubber tubes 6 which in turn lead to spouts 7. The flow through each tube 6 can be stopped by pushing a device 16 into contact with the tube. Each spout 7 has a nozzle 8 on which a bag can be held by a gripper 10. The spout 7 is suspended by rods 9 from a weighing beam (not shown) which rotates with the tank and when each bag is to be released the gripper 10 is lifted by a mechanism which includes a roller 11 operated by a cam rail. All the parts so far described, except the conical wall 14, are of usual construction. The wall 14 serves to direct the material to the discharge openings.

The shaft 2 is hollow and formed with openings 18. Compressed air is introduced through a stationary pipe 19 which enters the lower end of the shaft 2 and this air flows through the openings 18 into a space 17 within the conical wall 14 and above the bottom 32. The air flows from the space 17 through pipes 20 to circular pipes 25 which run around the bottom of the tank and are arranged one on each side of the row of openings 5. These pipes are made of porous material so that the air in them bows out in a multiplicity of smal lstreams and mixes with the powdered material above the openings 5. It converts this material to a fluid state so that the material can flow uniformly through the opening to the bags. The features just described are the subject of Application No. 21858/46.

The baffle system provided according to the present invention consists of bars 26 extending downwards from the cover 13 and on reaching the cone 14 running more or less parallel to it, these bars being held by three rings 27, 28 and 29. The ring 29 is fixed to the lower end of the bars and plate-like elements or arms 30 which lie in or close to radial planes of the tank are fixed to it. These elements 30 are in fact the wings of U-shaped members the bases of which are welded to the rings 29 as shown in Figure 3 of the drawings accompanying Provisional Specification No. 15986/48. When the tank rotates the baffle system remains stationary and the existence of the elements 30 ensures that the material immediately above the pipes 25 is constantly disturbed and levelled so that as each outlet 5 travels beneath the elements 30 the material will flow uniformly and rapidly to and through it.

It will be seen that in the construction described above the air is admitted above the mouths of the discharge openings. This may lead to the formation of pockets in the material and these can be avoided by the modified construction shown in Figures 4 and 5 of the drawings accompanying Provisional Specification No. 15986/48. Here the air enters the tank through porous plates 21 which lie in a frame forming the upper part of an air supply chamber 22 with inlets 23. The mouths of the discharge openings 5 lie in the same planes as the upper surfaces of the plates 21 and this plane is only just below the lower edges of the plate-like elements 30. With the construction shown no air will be supplied in the small area around each of the outlet openings 5 but of course the plates may be so shaped that they surround these openings closely.

Naturally some powdered materials are inherently more fluid than others and it is found that with the more fluid material it is possible to eliminate the air supply entirely. A particular example is ordinary Portland cement, which often contains a considerable amount of

occluded air. With other materials it is necessary only to supply air as described above while the machine is being started.

Figure 1 of the accompanying drawings shows a tank in which the means for supplying air are omitted completely. Radial arms 30 carried by bars 26 support a continuous annular stationary plate 33 so that only a small length of each arm 30 projects beyond the plate. When the tank is rotated, the plate 30 takes most of the weight of the material so that the tank need not immediately carry all the material round with it. A conical mass of stationary material builds up on the plate 33, and material from the upper part of the tank slides over this conical mass and so is directed to the annular area in which the discharge openings lie. In the absence of the horizontal plate the material would be checked by the baffle system and so tend to remain stationary while the tank turned. The friction between the stationary material and the bottom of the moving tank would impose considerable resistance and might overload the driving motor of the tank. For the same reason the bars 26 are placed as close as possible to the shaft 2 and conical wall 14, which rotate with the tank. As the tank rotates, only the free ends of the arms 30 act as baffles to the part of the material carried round by the tank, these ends lying wholly in a narrow annular area that includes the discharge openings, but it is found that these free ends break up the mass of material enough to make it flow uniformly through the discharge openings.

In the tank shown in Figure 2 of the accompanying drawings the conical wall 14 is entirely omitted, and the bars 26 carry a plate 34 which substantially covers the bottom area within the outlet openings 5. However, even in the absence of the wall 14 a conical mass builds up on the plate 34 in the same way as on the plate 33, so that the material is directed to the openings 5. At the periphery of the plate 34 there are arms, teeth or the like 35. The plate 34 may be replaced by plates of other shape, for example, by a conical plate 36 indicated in dotted lines.

It is to be understood that although the invention is illustrated as applied to the kind of machine shown in Figure 1 of the drawings accompanying Provisional Specification No. 15986/48 it is not limited to this type of machine since the weighing devices, the filling spouts and the air-supply devices may all be of other forms. Moreover the baffle system may be varied; for example the conical wall 14 may be replaced by a cylinder and the bars of the baffle system may then be wholly parallel to the axis of the tank. Again, the elements 30 may be carried by vertical arms and may form the ends of such arms, and there may be additional elements 30 above those shown.

Moreover, the baffle system illustrated in Figure 1 of the drawings accompanying Provisional Specification No. 15986/48 may be used in a tank having no air-supply means and the tanks shown in Figures 1 and 2 of the accompanying drawings may be provided with air-supply means.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A weighing and packing machine for powdered materials in which a tank rotates about a vertical axis and carries with it a series of filling spouts leading from discharge openings lying at the bottom of the tank and disposed around the axis, the bags being suspended on these spouts during the filling operation; the discharge openings lie in a narrow area at the bottom of and close to the periphery of the tank; the tank is so constructed, or provided with internal elements such, that the material within it is directed radially outwards to the narrow area and so to the discharge openings; and a fixed baffle system is provided within the tank immediately above the discharge openings to stop the mass of powdered material from being carried round as a whole with the tank.

2. A machine according to claim 1 in which there are means for introducing air or other gas under pressure into the material in a multiplicity of small streams in the neighbourhood of the discharge openings to convert it into a fluid state.

3. A machine according to claim 2 in which the air or gas enters the tank through porous surfaces lying in substantially the same plane as the mouths of the discharge openings.

4. A machine according to any of claims 1 to 3 in which the baffle system includes arms or plate-like elements lying in or close to radial planes of the tank.

5. A machine according to claim 4 in which the arms or elements project beyond an annular stationary plate.

Dated this 10th day of May, 1949.

For the Applicants:
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
51/52, Chancery Lane,
London, W.C.2.

Leamington Spa: Printed for His Majesty's Stationery Office, by the Courier Press.—1951.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies, price 2s. per copy; by post 2s. 1d. may be obtained.

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

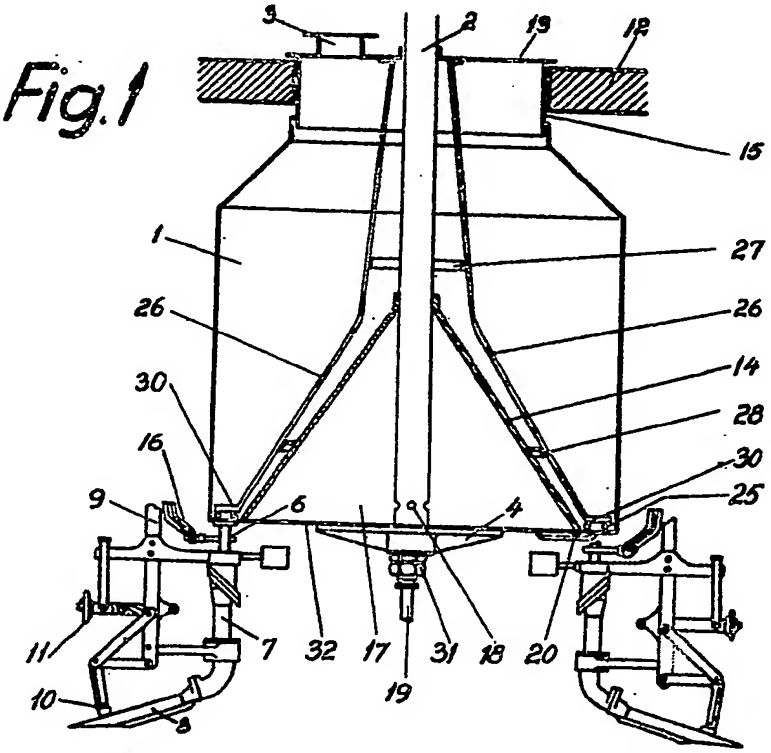


Fig. 2

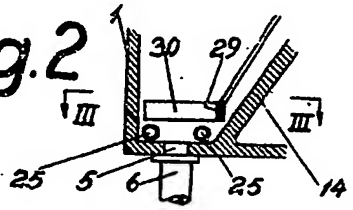


Fig. 4

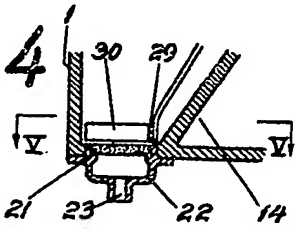


Fig. 3

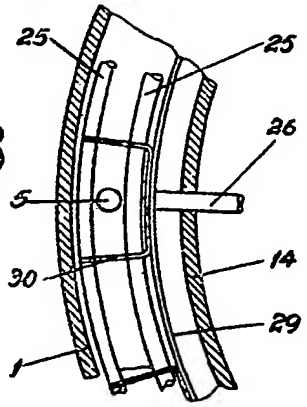
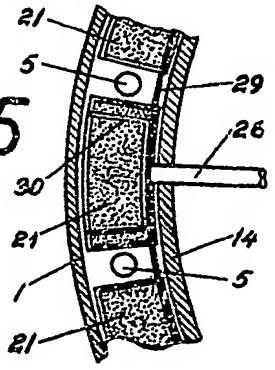


Fig. 5



H.M.S.O. (Ty.P.)

[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

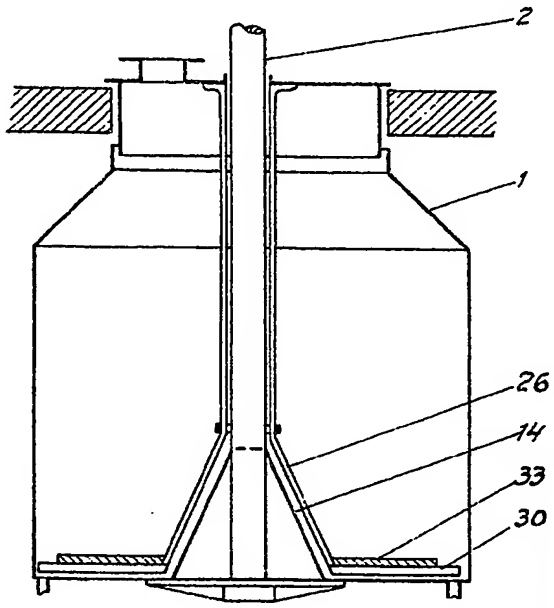
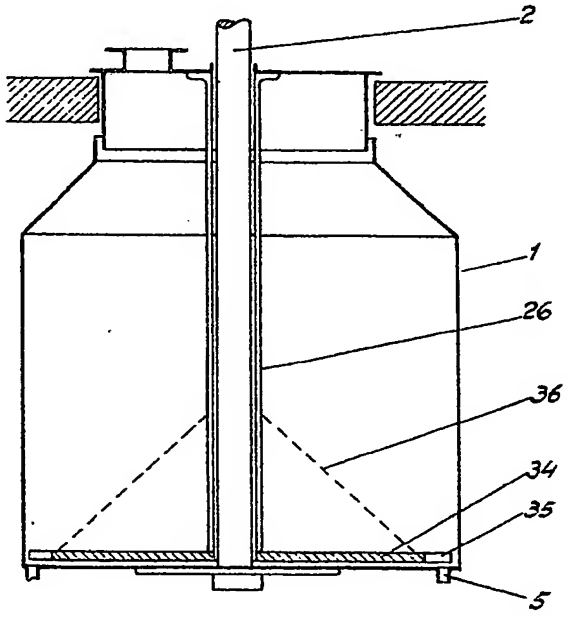


Fig. 2.



H.M.S.O. (Ty. P.)